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REMARKS

Claims 1-25 were pending in the subject application, with claims 15-23 and 25 having been withdrawn by the Patent Office from consideration. Applicants have hereinabove canceled claim 24 and amended claims 4, 6, 7, 10 and 13, to place the claims in better form for examination. Accordingly, claims 1-14 are presented for examination.

Applicants maintain that no new matter is presented by this amendment. Accordingly, Applicants respectfully request that this Amendment be entered.

Objection To The Claims

On page 3 of the September 9, 2003 Office Action, claims 4-14 were objected to under 37 CFR 1.75(c) as purportedly being in improper form.

The Examiner stated that a multiple dependent claim cannot depend on a multiple dependent claim.

In response, Applicants have amended the claims to remove any multiple dependencies.

Accordingly, Applicants respectfully request withdrawal of the objection to the claims.

Rejection under 35 U.S.C. §112, second paragraph

On page 2 of the September 9, 2003 Office Action, claim 24 was rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

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The Examiner stated that claim 24 is drawn to the specification in its entirety and the accompanying drawings. The Examiner also stated that the specification is comprised of many parts, some of these being background, that is, prior art. The Examiner further stated that a claim cannot refer to the specification in its entirety because it contains prior art. The Examiner stated that the drawings may be subject to changes throughout the prosecution.

In response, Applicants have hereinabove canceled claim 24. Therefore, the rejection is now moot.

Accordingly, Applicants respectfully request withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

Rejection Under 35 U.S.C. §102(b)

On page 3 of the September 9, 2004 Office Action, claims 1 and 3 were rejected under 35 U.S.C. §102(b) as purportedly anticipated by U.S. Patent No. 6,468,356 to Crema et al. (hereinafter "Crema '356").

The Examiner stated that Crema '356 discloses a method for removing residues of molding material from metal parts of plastic packages of semiconductor devices. The Examiner also stated that the method includes using two laser pulses; the first pulse has a wavelength, which is absorbed by the thicker residues, and the second pulse has a wavelength for thinner or transparent residues. The Examiner further stated that the intensity and duration of the pulses removes the residues. The Examiner stated that a YAG laser is used with a wavelength of about 1064 nm (infra-red light). The Examiner also stated that pulse durations

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are between 6 and 8 ns. The Examiner further stated that the pulse repetition frequency is around 30 Hz and that other types of lasers may be used.

Applicants maintain that the claimed invention cannot be anticipated by Crema '356 because Crema '356 fails to disclose each and every element of the claimed invention.

This application relates to deflashing integrated circuit packages, and in particular removing flash from heat sinks and other portion of IC packages, with causing damage.

For example, independent claim 1 is directed to a method of deflashing IC packages. The method comprises directing a first laser beam in the infra-red frequency range onto flash area for removing top layer of flash, and subsequently directing a second laser beam onto the flash area at low laser fluence and pulse number for removing the thin layer of flash remained after application of the first laser beam.

Crema '356 is directed to removing molding residues in the fabrication of plastic packages for semiconductor devices. Crema '356 discloses an apparatus for removing the residues of plastic. The apparatus includes a laser 20 which provides pulsed output radiation having a wavelength of 1,064 nm. Crema '356 also discloses that two different lasers with different output wavelengths can be used.

The choice of wavelength of the second pulse laser in Crema '356 depends on whether the molding residues are transparent to it.

In contrast, according to the present application, the choice of wavelength of the second pulsed laser beam depends on whether the molding residues are absorbed to it. For example, the wavelength of the second laser is 1064 nm beam, according to an embodiment shown in Fig. 5 of the present application. The thin flash or residue is absorbed to it and can be effectively removed based on laser ablation of thin flash or residue. Since the molding residue of Crema '356 is not transparent to 1064 nm, it cannot be used in Crema '356 as a second laser beam. In fact, the wavelength of the second laser in Crema '356 is in a range of about 180 to 700 nm.

The choice of laser intensity of the second laser also distinguishes the present application from Crema '356. In Crema '356, high laser intensity of the second pulse laser beam must be used to remove thin flash or residue. This is because only high laser intensity can result in the formation of plasma originated from the transformation of the metal atoms and metal oxide atoms located on that surface of the item to be treated (e.g. heat-sink). In contrast, according to the present application, low laser intensity of the second laser beam is chosen, because low laser intensity can result in laser ablation of thin flash or residue as thin flash or residue is absorbed to laser. Another key issue for choosing low laser intensity is to avoid any damage to metal surface. High laser intensity easily induces damage to the metal surface such as laser ablation of metal surface and laser-induced oxidation of metal surface in the air. In fact, little removal of metal from its surface or damage to metal surface takes place in Crema '356, as evident from the formation of plasma originated from transformation of the metal atoms and metal oxide atoms located on that surface of the item.

In addition, the choice of pulse duration of the first laser is quite different as between Crema '356 and the present application. The pulse duration is in a range of about 3 to 30 ns in Crema '356, and the first laser is pulsed laser in Crema '356. In contrast, according to the present application, the first laser is operated in a continuous wave mode or pulses of length in excess of 1 μ s, which is an important difference between the present application and Crema '356. Due to low thermal conductivity and diffusivity of flash materials, the temperature rise of the top layer is so high that the top layer of thick flash is easily evaporated by the first laser irradiation. Only the thin layer of flash existed on heat sinks. The temperature rise of the thin flash is not only dependent on thin flash absorption of laser energy, but also on the thermal properties of heat sinks. The low temperature rise is induced by the first laser irradiation with long pulse duration so that the thin flash is not fully evaporated and remains on the heat sink surface. In fact, the first laser with the long pulse duration in the present invention plays two roles. One is to remove the top layer of the thick flash. Another is to maintain a thin flash on the heat sink or metal surface, which can prevent the heat sink or metal surface from being damaged during the first laser deflashing. This is because the high laser intensity is usually chosen for the first laser beam for fast removal at the top layer of thick flash. If no thin flash exists on the heat sink or metal surface, it easily induces damage of heat sink or metal surface for the first laser irradiation at high laser intensity.

Typically, the thickness of flash or residue on the heat sink or metal surface is not uniform. If the first laser is a pulsed YAG laser (1064 nm) with a short pulse duration as disclosed in Crema

'356, it is very difficult (if not impossible) to control the pulse number for only removal of the top layer of thick flash without damaging the heat sink or metal surface for the non-uniform flash or residue on the heat sink or metal surface. This is because both the thin flash and thick flash are all absorbed to it, leading to ablation of flash. If the pulse number is the same during the first laser irradiation, damage to the heat sink or metal surface may take place on locations covered by the thin flash before removal of top layer of thick flash. However, since the first laser in the present application is a pulsed laser with long pulse duration or even a continuous wave laser, only the top layer of thick flash is removed. A thin flash will remain on the heat sink surface after the first laser deflashing. This means that no matter how the flash distributes on the heat sink or metal surface, the first laser is only effective to remove the top layer of thick flash. After the first laser deflashing, only thin flash remains, which will be removed by the second laser at low laser intensity.

Since Crema '356 does not disclose or suggest each and every feature of the claimed invention, Crema '356 cannot render the claimed invention unpatentable.

Regarding claim 3, Applicants respectfully point out that claim 3 depends on and includes all the limitations of claim 1. Thus, claim 3 is patentable at least for the reasons set forth above with respect to claim 1.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §102(b).

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Rejection Under 35 U.S.C. §103(a)

On page 4 of the September 9, 2003 Office Action, claims 2 and 3 were rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Crema '356.

The Examiner acknowledged that Crema '356 does not disclose the use of a CO₂ laser.

The Examiner alleged that it is well known in the art that lasers of different types have wide overlaps and hence different types of lasers may be considered functional equivalents. The Examiner further alleged that it would have been obvious to one of ordinary skill in the art at the time of the invention to use a CO₂ laser in place of a YAG, because other types of lasers may be used in the Crema '356 cleaning method.

Applicants maintain Crema '356 does not render obvious the invention claimed in claims 2 or 3.

As discussed above, Crema '356 does not disclose or suggest each and every feature of the invention claimed in claim 1 from which claims 2 and 3 depend. Since claims 2 and 3 include all of the features recited in claim 1, the claimed invention recited in claim 2 and 3 is patentable over Crema '356 for at least the very same reasons that claim 1 is thought to be allowable.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §103(a).

In view of the amendments to the claims and remarks hereinabove, Applicants maintain that claims 1-14 are now in condition for allowance. Accordingly, Applicants earnestly solicit the

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allowance of the application.

If a telephone interview would be of assistance in advancing prosecution of the subject application, Applicants' undersigned attorneys invite the Examiner to telephone them at the telephone number provided below.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition, and the Commissioner is authorized to charge the requisite fees to our Deposit Account No. 03-3125.

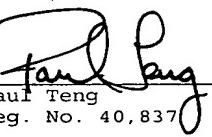
No fee is deemed necessary in connection with the filing of this Amendment. However, if any additional fee is required, authorization is hereby given to charge the amount of any such fee to Deposit Account No. 03-3125.

Respectfully submitted,



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I hereby certify that this correspondence is being deposited this date with the U.S. Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

 December 8, 2003
Date

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